

THE *GEOMYDOECUS* (MALLOPHAGA: TRICHODECTIDAE) FROM
THE CENTRAL AMERICAN POCKET GOPHERS OF THE
SUBGENUS *MACROGEOMYS* (RODENTIA: GEOMYIDAE)¹

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Abstract.—Six species and subspecies of *Geomydoecus* from *Orthogeomys* (*Macrogeomys*) pocket gophers are described and illustrated: *G. panamensis panamensis* Price and Emerson from *O. (M.) cavator* (Bangs); *G. p. dariensis* Price and Emerson from *O. (M.) dariensis* (Goldman); *G. setzeri* Price and *G. davidhaffneri* new species from *O. (M.) underwoodi* (Osgood) and *O. (M.) cherriei* (J. A. Allen); *G. costaricensis* Price and Emerson from three subspecies of *O. (M.) heterodus* (Peters); and *G. cherriei* Price from *O. (M.) cherriei* and *O. (M.) matagalpae* (J. A. Allen). Keys are provided for the identification of these six taxa.

Price and Emerson (1971), in a revision of the mallophagan genus *Geomydoecus* Ewing, recognized three new species of lice from the Central American pocket gophers of the genus *Macrogeomys* Merriam, now considered a subgenus of *Orthogeomys* Merriam by Hall (1981): *G. panamensis* from *M. cavator* Bangs; *G. dariensis* from *M. dariensis* Goldman; and *G. costaricensis* from *M. heterodus cartagoensis* (Goodwin). Subsequently, Price (1974) described two more new species: *G. setzeri* from *M. underwoodi* Osgood and *G. cherriei* from *M. cherriei* (J. A. Allen). These five species were based on a relatively limited number of louse specimens representing only one or a few localities per taxon, with the extreme case being *G. cherriei* described from a single male. Recently, one of us (MSH) had the opportunity to do extensive collecting of *Macrogeomys* gophers in Panama and Costa Rica. This has resulted in the procurement of excellent series of lice for each of the five described taxa as well as material representing a sixth as yet undescribed species. It is our purpose here to present descriptions of these six taxa and to provide keys for their identification.

Quantitative data for the *panamensis* complex lice combined with host and

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locality information form part of a computerized pocket gopher-louse data base which is maintained at the University of Notre Dame. The retrieval and analysis of the data for this study were performed with an integrated group of computer programs called the BUG system. A description of this system and its use in taxonomic decision-making, and for the analysis, summarization, and display of louse character and distribution data are given in Hellenthal and Price (1980). Locality information for the hosts included in this study, including latitude, longitude, and in some cases elevation, is available from the authors.

Counted or measured characters in the following descriptions are followed by the minimal and maximal observed values, and, in parentheses, the sample size, mean, and standard deviation. All measurements are in millimeters. Illustrations are from material off the type-host. In evaluating character usefulness for specific discrimination, critical values for each character were calculated at the point where the likelihood of single character misidentification of the two compared taxa was equal, given normality and equal variance, and ignoring the probability of collection. For characters offering moderately good discriminating ability, these critical values and the corresponding probabilities of misidentification are given. In an abbreviated comparative description for a species or subspecies, quantitative data are given only for those characters whose means differ at a significance level of $P \leq 0.01$. In the "Material examined" section, a number in parentheses following a locality indicates the total number of gophers from which lice were taken. Original locality data expressed in miles are followed parenthetically by the metric equivalent to 0.1 km; the English figure, rather than the metric, expresses the precision of the location estimate. Price and Hellenthal (1980) provide labelled illustrations of pertinent structural and dimensional characters.

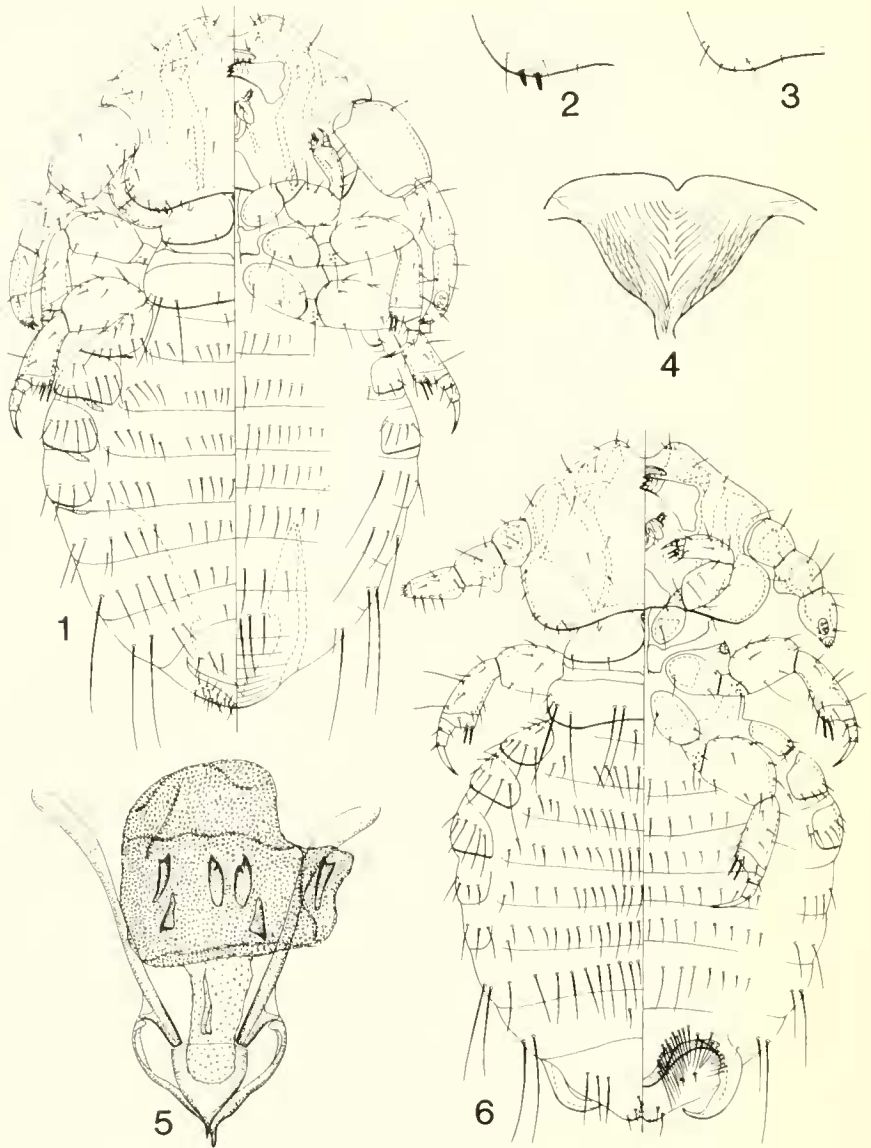
The six taxa included in the *panamensis* complex are the only *Geomydoecus* known from gophers in the subgenus *Macrogeomys* and they share the following characteristics: (1) both sexes with submarginal temple seta on line with to mediad of inner marginal seta (Figs. 2, 3); (2) male with pair of spiniform setae on temple margin (Figs. 2, 11); (3) male without process on posterior scape margin (Fig. 1); (4) male genital sac with 3–6 prominent spines (Figs. 5, 7–10); (5) female with 3 lateral setae of last tergite close together on each side (Fig. 6); (6) female subgenital plate and postvulval sclerite with setal lengths and distribution as in Fig. 6; and (7) female genital sac with concave anterior margin and without conspicuous transverse loops (Figs. 4, 12–14).

Geomydoecus panamensis Price and Emerson

Figs. 1–6

Geomydoecus panamensis Price and Emerson, 1971: 251. Type-host: *Macrogeomys cavator* = *Orthogeomys* (*Macrogeomys*) *cavator* (Bangs).

Male.—As in Fig. 1. Temple width 0.530–0.655 (28: 0.591 ± 0.0314); head length 0.405–0.455 (27: 0.421 ± 0.0138); submarginal and inner marginal temple setae 0.025–0.040 (17: 0.032 ± 0.0040) and 0.015–0.030 (24: 0.024 ± 0.0028) long, respectively. Antenna with scape length 0.230–0.275 (19: 0.250 ± 0.0121), scape medial width 0.130–0.180 (18: 0.153 ± 0.0146), scape distal width 0.140–0.180 (18: 0.158 ± 0.0126). Prothorax width 0.385–0.455 (26: 0.421 ± 0.0185). Tergal setae: I, 2; II, 10–17 (27: 13.2 ± 1.80); III, 19–27 (27: 22.8 ± 2.09); IV, 21–28 (27: 24.6 ± 1.57); V, 19–26 (27: 22.1 ± 1.82); VI, 13–20 (26: $16.8 \pm$



Figs. 1-6. *Geomydoecus panamensis panamensis*. 1, Male. 2, Male temple margin. 3, Female temple margin. 4, Female genital sac. 5, Male genitalia. 6, Female.

1.65); tergal and pleural setae on VII, 18-24 (26: 20.5 ± 1.58). Sternal setae: II, 6-11 (25: 9.5 ± 1.23); III, 10-13 (25: 12.1 ± 0.91); IV, 12-18 (26: 15.0 ± 1.47); V, 8-16 (26: 12.9 ± 1.80); VI, 6-12 (27: 9.9 ± 1.80); VII, 3-9 (27: 6.4 ± 1.48); VIII, 5-8 (26: 6.3 ± 0.67). Total length 1.520-1.795 (26: 1.634 ± 0.0719). Genitalia as in Fig. 5; sac having 6 large spines, with outer anterior pair long, slender; parameral arch width 0.190-0.235 (28: 0.216 ± 0.0094); endomeral plate tapered to sharp point, width 0.105-0.125 (28: 0.116 ± 0.0054), length 0.115-0.145 (28: 0.136 ± 0.0070).

Female.—As in Fig. 6. Temple width 0.570-0.690 (30: 0.637 ± 0.0367); head

length 0.390–0.445 (29: 0.417 ± 0.0158); submarginal and inner marginal temple setae 0.025–0.040 (20: 0.031 ± 0.0048) and 0.015–0.025 (30: 0.018 ± 0.0028) long, respectively. Prothorax width 0.395–0.485 (30: 0.448 ± 0.0245). Tergal setae: I, 2; II, 13–18 (30: 14.6 ± 1.43); III, 21–27 (30: 23.7 ± 1.49); IV, 22–30 (30: 26.6 ± 1.50); V, 22–29 (30: 25.7 ± 1.77); VI, 21–30 (30: 24.9 ± 1.96); tergal and pleural setae on VII, 22–35 (29: 29.1 ± 2.55). Longest seta of medial 10 on tergite VI, 0.065–0.100 (29: 0.080 ± 0.0097); on tergite VII, 0.115–0.170 (24: 0.146 ± 0.0153), with 7–8 (22: 8.0 ± 0.21) of these longer than 0.100. Longest seta of medial pair on tergite VIII, 0.035–0.090 (28: 0.052 ± 0.0149). Each side of last tergite with outer seta 0.075–0.130 (21: 0.109 ± 0.0142), middle seta 0.085–0.145 (23: 0.113 ± 0.0124), inner seta 0.090–0.120 (24: 0.107 ± 0.0080) long. Sternal setae: II, 8–11 (27: 8.9 ± 0.83); III, 10–14 (27: 11.6 ± 1.01); IV, 10–16 (27: 13.2 ± 1.78); V, 8–15 (29: 12.3 ± 1.96); VI, 9–17 (29: 12.6 ± 2.16); VII, 10–17 (29: 13.1 ± 1.87). Subgenital plate with 31–46 (30: 38.4 ± 3.61) setae. Total length 1.395–1.770 (30: 1.593 ± 0.0847). Genital sac as in Fig. 4, width 0.365–0.515 (30: 0.443 ± 0.0337), length 0.255–0.340 (30: 0.302 ± 0.0214), with about 12 subparallel lines on each side, lateroanterior “horns” essentially without lines, and medioanterior indentation varying from “V” to “U” shaped.

Discussion.—The shape of the male endomeral plate and number of genital sac spines allies *G. panamensis* with *G. setzeri* and the new species (Fig. 5 vs. Figs. 7, 8), thereby separating it from both *G. costaricensis* and *G. cherriei*. However, both sexes of *G. panamensis* are consistently larger in most dimensions than either *G. setzeri* or the new species. Further details for separation will be given in the subsequent descriptions.

***Geomydoecus panamensis panamensis* Price and Emerson, NEW STATUS**

Figs. 1–6

Male.—Temple width 0.530–0.625 (22: 0.580 ± 0.0246). Submarginal temple seta 0.025–0.040 (16: 0.032 ± 0.0036) long. Prothorax width 0.385–0.455 (20: 0.416 ± 0.0175). Sternal setae: II, 6–11 (19: 9.2 ± 1.23); V, 11–16 (20: 13.4 ± 1.32); VI, 7–12 (21: 10.5 ± 1.44); VII, 6–9 (21: 7.0 ± 1.05).

Female.—Temple width 0.570–0.685 (22: 0.609 ± 0.0274). Prothorax width 0.395–0.480 (22: 0.431 ± 0.0219). Tergal setae on II, 12–17 (22: 14.0 ± 1.27). Longest seta of medial 10 on tergite VI, 0.070–0.100 (21: 0.085 ± 0.0096); on tergite VII, 0.115–0.170 (18: 0.139 ± 0.0155). Sternal setae: IV, 11–18 (16: 14.2 ± 1.90); V, 10–16 (18: 13.4 ± 1.61); VI, 9–17 (19: 13.5 ± 2.12); VII, 11–17 (21: 13.7 ± 1.62). Subgenital plate with 31–43 (22: 36.9 ± 3.69) setae. Genital sac length 0.255–0.330 (22: 0.293 ± 0.0213).

Material examined.—25 ♂, 30 ♀, *O. (M.) cavator*, Panama, Prov. Chiriqui, Boquete Trail (3), Boquete (2), Cerro Punta (2), Santa Clarita, 32.5 km W Volcan (2); Costa Rica, Prov. San Jose, Division (1). 3 ♀, *O. (M.) cavator pansa* (Bangs), Panama, Prov. Chiriqui, Bugaba (2). Questionable host records: 6 ♂, 10 ♀, *O. (M.) [heterodus (Peters)?]*, Costa Rica, Prov. San Jose, La Piedra, 4 km SW Cerro Chirripo (1), Fila la Maquina, 7.5 km E Canaan (1). 1 ♂, *O. (M.) [heterodus cartagoensis (Goodwin)?]*, Costa Rica, Prov. Cartago, El Sauce Peralta (1).

***Geomydoecus panamensis dariensis* Price and Emerson, NEW STATUS**

Geomydoecus dariensis Price and Emerson, 1971: 251. Type-host: *Macrogeomys dariensis* = *Orthogeomys (Macrogeomys) dariensis* (Goldman).

Male.—Temple width 0.605–0.655 (6: 0.630 ± 0.0180). Submarginal temple seta 0.040 long. Prothorax width 0.415–0.450 (6: 0.436 ± 0.0129). Sternal setae: II, 9–11 (6: 10.3 ± 0.82); V, 8–14 (6: 11.0 ± 2.00); VI, 6–10 (6: 7.8 ± 1.47); VII, 3–6 (6: 4.5 ± 1.05).

Female.—Temple width 0.630–0.690 (13: 0.667 ± 0.0203). Prothorax width 0.445–0.480 (13: 0.465 ± 0.0092). Tergal setae on II, 13–18 (13: 15.2 ± 1.42). Longest seta of medial 10 on tergite VI, 0.065–0.090 (13: 0.076 ± 0.0069); on tergite VII, 0.140–0.170 (10: 0.155 ± 0.0087). Sternal setae: IV, 10–14 (13: 12.5 ± 1.66); V, 8–14 (13: 11.2 ± 1.86); VI, 9–15 (13: 11.6 ± 1.71); VII, 10–16 (13: 12.3 ± 1.80). Subgenital plate with 36–46 (13: 39.7 ± 2.90) setae. Genital sac length 0.290–0.340 (13: 0.314 ± 0.0146).

Discussion.—The best means for distinguishing males of *G. p. dariensis* from those of the nominate subspecies, with their critical values for discrimination and probabilities of misidentification, were the number of setae on sternite VII 5.75 (0.117), the temple width 0.605 (0.142), and the number of setae on sternite VI 9.15 (0.180); the best for distinguishing females of *G. p. dariensis* were the temple width 0.638 (0.125) and prothorax width 0.448 (0.173).

Material examined.—12 ♂, 23 ♀, *O. (M.) dariensis*, Panama, Prov. Darien, Cana (5), E slope Cerro Pirre, 6 km NW Cana (2), Jaque (1), Rio Tuira at Rio Mono (1).

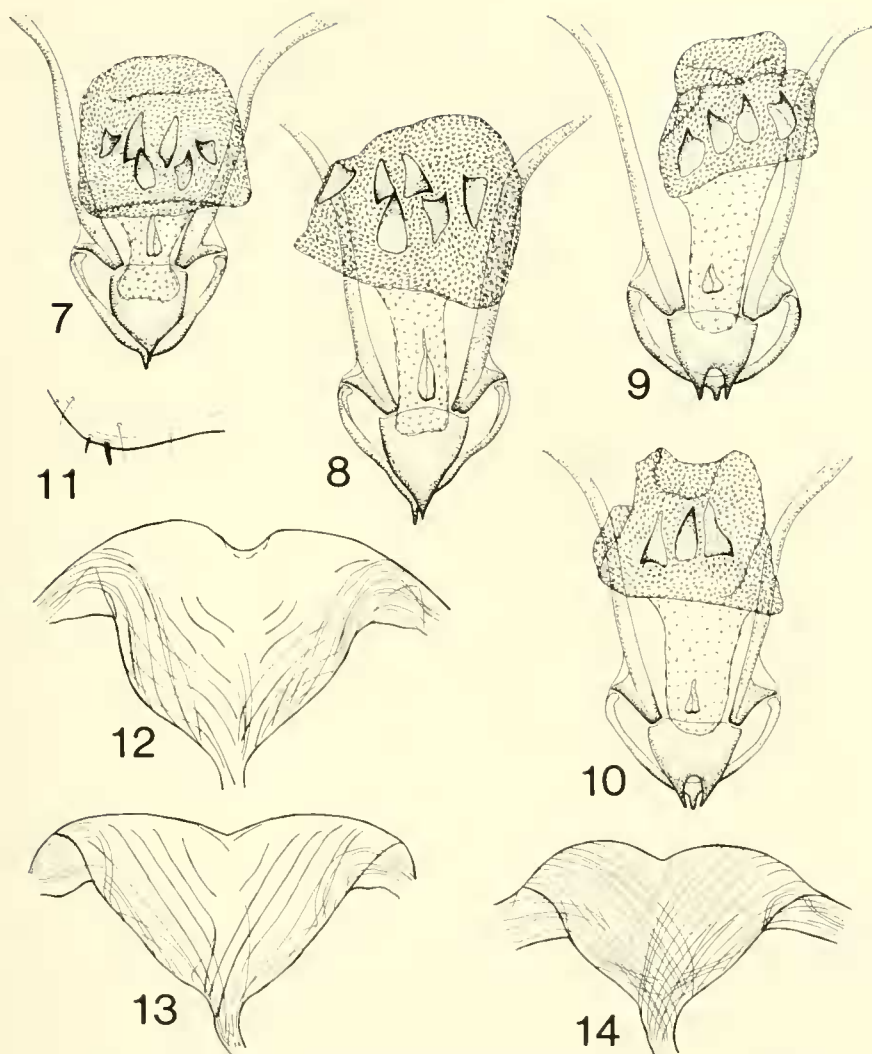
Geomydoecus setzeri Price

Figs. 7, 11, 12

Geomydoecus setzeri Price, 1974: 41. Type-host: *Macrogeomys underwoodi* = *Orthogeomys (Macrogeomys) underwoodi* (Osgood).

Male.—Much as in Fig. 1. Temple width 0.460–0.500 (15: 0.480 ± 0.0120); head length 0.305–0.355 (16: 0.326 ± 0.0131); submarginal and inner marginal temple setae 0.020–0.030 (9: 0.025 ± 0.0025) and 0.015–0.025 (13: 0.020 ± 0.0032) long, respectively, with outer marginal temple seta usually more slender and pointed than inner (Fig. 11). Antenna with scape length 0.170–0.195 (14: 0.186 ± 0.0074), scape medial width 0.100–0.130 (14: 0.115 ± 0.0082), scape distal width 0.105–0.135 (14: 0.121 ± 0.0075). Prothorax width 0.330–0.365 (17: 0.345 ± 0.0095). Tergal setae: I, 2; II, 8–11 (18: 9.8 ± 0.62); III, 16–21 (18: 18.1 ± 1.59); IV, 16–20 (19: 18.1 ± 1.41); V, 14–19 (19: 16.2 ± 1.40); VI, 12–17 (19: 14.2 ± 1.34); tergal and pleural setae on VII, 17–24 (19: 20.1 ± 1.49). Sternal setae: II, 7–9 (19: 8.1 ± 0.62); III, 6–12 (19: 9.3 ± 1.73); IV, 8–16 (20: 10.8 ± 2.13); V, 6–13 (20: 9.0 ± 1.70); VI, 4–9 (20: 6.2 ± 1.48); VII, 4–6 (20: 4.2 ± 0.52); VIII, 5–8 (20: 6.8 ± 1.01). Total length 1.040–1.280 (15: 1.195 ± 0.0591). Genitalia as in Fig. 7; sac having 6 large spines, with outer anterior pair relatively short; parameral arch width 0.125–0.145 (20: 0.136 ± 0.0050); endomeral plate tapered to sharp point, width 0.065–0.075 (20: 0.072 ± 0.0029), length 0.075–0.090 (20: 0.084 ± 0.0052).

Female.—Much as in Fig. 6. Temple width 0.495–0.545 (23: 0.518 ± 0.0130); head length 0.300–0.345 (23: 0.326 ± 0.0130); submarginal and inner marginal temple setae 0.020–0.030 (19: 0.027 ± 0.0029) and 0.010–0.015 (22: 0.015 ± 0.0015) long, respectively. Prothorax width 0.345–0.395 (26: 0.368 ± 0.0112). Tergal setae: I, 2; II, 10–15 (26: 12.3 ± 1.40); III, 18–23 (27: 20.3 ± 1.68); IV, 17–23 (27: 20.8 ± 1.73); V, 17–25 (27: 21.0 ± 2.21); VI, 18–25 (27: $20.7 \pm$



Figs. 7-10. Male genitalia. 7, *Geomydoecus setzeri*. 8, *G. davidhafneri*. 9, *G. costaricensis*. 10, *G. cherriei*. Fig. 11, *G. setzeri* male temple margin. Figs. 12-14. Female genital sac. 12, *G. setzeri*. 13, *G. costaricensis*. 14, *G. cherriei*.

1.86); tergal and pleural setae on VII, 24-32 (28: 28.0 ± 2.20). Longest seta of medial 10 on tergite VI, 0.050-0.070 (26: 0.064 ± 0.0055); on tergite VII, 0.100-0.155 (22: 0.116 ± 0.0129), with 0-9 (20: 5.4 ± 2.80) of these longer than 0.100. Longest seta of medial pair on tergite VIII, 0.020-0.050 (24: 0.029 ± 0.0077). Each side of last tergite with outer seta 0.065-0.100 (25: 0.082 ± 0.0077), middle seta 0.070-0.100 (24: 0.088 ± 0.0067), inner seta 0.075-0.100 (22: 0.088 ± 0.0069) long. Sternal setae: II, 7-10 (28: 8.1 ± 0.72); III, 6-11 (26: 8.3 ± 1.23); IV, 7-13 (26: 9.7 ± 1.57); V, 7-13 (27: 9.4 ± 1.69); VI, 8-12 (28: 9.7 ± 1.36); VII, 8-13 (28: 10.6 ± 1.23). Subgenital plate with 21-32 (28: 27.5 ± 2.40) setae. Total length 1.145-1.410 (20: 1.269 ± 0.0687). Genital sac as in Fig. 12, width

0.255–0.355 (27: 0.292 ± 0.0237), length 0.190–0.270 (26: 0.220 ± 0.0173), with at least 1 side having 10 or fewer subparallel lines, lateroanterior “horns” with number of conspicuous lines, and broad gently curved medioanterior indentation.

Discussion.—Qualitatively, the smaller outer anterior pair of genital sac spines (Fig. 7 vs. Fig. 5) and the more slender pointed outer marginal temple seta (Fig. 11 vs. Fig. 2) will separate males of *G. setzeri* from those of *G. panamensis*. Quantitatively, the males of *G. setzeri* are consistently much smaller, with the best characters and their critical values for discrimination and probabilities of misidentification being the genitalie parameral arch width 0.176 (0.000), the endomeral plate width 0.094 (0.000), the endomeral plate length 0.110 (0.000), the total length 1.414 (0.001), and the scape length 0.218 (0.001).

The only qualitative feature useful in separating female *G. setzeri* from *G. panamensis* consists of the genital sac shape and distribution of the lines (Fig. 12 vs. Fig. 4). Quantitatively, the females of *G. setzeri* are, as with the males, much smaller than those of *G. panamensis*, with the best characters being the head length 0.372 (0.001), the width of the genital sac 0.368 (0.005), the total length 1.431 (0.020), and the temple width 0.578 (0.021). We have been unable to distinguish the females of *G. setzeri* from those of the new species that follows, even though the males of these 2 taxa are readily separable; therefore, the above description for female *G. setzeri* likely includes females for both that species and the new species.

Material examined.—12 ♂, 11 ♀, *O. (M.) underwoodi*, Costa Rica, Prov. Puntarenas, Jabillo Pirris (3), Parrita (1); Prov. San Jose, San Geronimo Pirris (1). 34 ♂, 58 ♀, *O. (M.) cherriei*, Costa Rica, Prov. Guanacaste, Las Juntas (3), 2 km N, 8 km W Las Juntas (1). Questionable host record: 3 ♂, 7 ♀, *O. (M.) [heterodus?]*, Costa Rica, Prov. Puntarenas, 5 mi (8.0 km) NE Palmar Norte (1).

Geomydoecus davidhafneri Price and Hellenenthal, NEW SPECIES

Fig. 8

Type-host.—*Orthogeomys (Macrogeomys) cherriei* (J. A. Allen).

Male.—As for *G. setzeri*, except as follows. Temple width 0.490–0.515 (8: 0.505 ± 0.0100); head length 0.335–0.355 (8: 0.345 ± 0.0084); submarginal temple seta 0.025–0.035 (3: 0.030 ± 0.0050); marginal temple setae as for *G. panamensis* (Fig. 2). Antenna with scape length 0.200–0.230 (5: 0.216 ± 0.0119), scape medial width 0.115–0.150 (5: 0.133 ± 0.0155), scape distal width 0.120–0.150 (5: 0.138 ± 0.0135). Prothorax width 0.335–0.385 (15: 0.359 ± 0.0129). Tergal setae on II, 9–12 (16: 10.6 ± 0.81); tergal and pleural setae on VII, 19–24 (16: 21.4 ± 1.63). Total length 1.300–1.455 (8: 1.377 ± 0.0552). Genitalia as in Fig. 8; parameral arch width 0.175–0.205 (16: 0.188 ± 0.0085); endomeral plate subtriangular, tapered to sharp point, width 0.095–0.110 (16: 0.102 ± 0.0039), length 0.100–0.125 (12: 0.111 ± 0.0077).

Female.—Apparently inseparable from *G. setzeri*.

Discussion.—The principal difference between male *G. davidhafneri* and *G. setzeri* involves the former having a much larger genitalia accompanied by subtle differences in shape of the endomeral plate and genital sac spines. This is expressed quantitatively by the best characters, with their critical values for discrimination and probabilities of misidentification, being the width of the endomeral plate 0.087 (0.000), the width of the parameral arch 0.162 (0.000), the length of the

endomerale plate 0.097 (0.015), and the length of the antennal scape 0.201 (0.040). The best quantitative characters separating male *G. davidhafneri* from *G. panamensis* are the head length 0.383 (0.001), the total length 1.506 (0.030), the prothorax width 0.390 (0.032), and the number of setae on tergite IV 21.61 (0.038).

The unusual occurrence of two species of the same louse complex on the same host individuals has contributed to our inability to separate females of *G. davidhafneri* from those of *G. setzeri*. This is based on our assumption that females of *G. davidhafneri* are indeed represented in our series of *G. setzeri* females; the number of *G. davidhafneri* males collected would certainly lead us to expect females of that species to be present.

This species is named for Dr. David J. Hafner, New Mexico Museum of Natural History, Albuquerque, in recognition of his interest in mammalian ectoparasites and his efforts in collecting many important gopher specimens.

Material examined.—Holotype ♂, *O. (M.) cherriei* (Louisiana State University Museum of Zoology-15775), Las Juntas, Prov. Guanacaste, Costa Rica, 3.IV.1970, A. B. McPherson; in collection of the University of Minnesota. Paratypes: 10 ♂, *O. (M.) cherriei*, Costa Rica, Prov. Guanacaste, Las Juntas (3), 2 km N, 8 km W Las Juntas (1); Prov. Alajuela, 7 km NE Quesada (1). Other specimens: 4 ♂, *O. (M.) underwoodi*, Costa Rica, Prov. Puntarenas, Jabillo Pirris (1), Parrita (1). 2 ♂, *O. (M.) heterodus*, Costa Rica, Prov. Puntarenas, 5 mi (8.0 km) NE Palmar Norte (1).

Geomydoecus costaricensis Price and Emerson

Figs. 9, 13

Geomydoecus costaricensis Price and Emerson, 1971: 251. Type-host: *Macrogeomys heterodus cartagoensis* = *Orthogeomys (Macrogeomys) heterodus cartagoensis* (Goodwin).

Male.—Much as in Fig. 1. Temple width 0.495–0.555 (20: 0.531 ± 0.0155); head length 0.360–0.410 (19: 0.389 ± 0.0123); submarginal and inner marginal temple setae 0.030–0.035 (15: 0.031 ± 0.0023) and 0.015–0.025 (19: 0.021 ± 0.0028) long, respectively. Antenna with scape length 0.185–0.225 (19: 0.210 ± 0.0102), scape medial width 0.115–0.145 (19: 0.130 ± 0.0076), scape distal width 0.120–0.150 (19: 0.134 ± 0.0076). Prothorax width 0.345–0.385 (19: 0.369 ± 0.0127). Tergal setae: I, 2; II, 10–13 (20: 11.6 ± 0.99); III, 16–23 (20: 20.4 ± 1.85); IV, 19–26 (20: 22.6 ± 2.08); V, 17–23 (19: 20.2 ± 2.09); VI, 12–20 (19: 15.8 ± 1.74); tergal and pleural setae on VII, 18–26 (19: 21.8 ± 1.93). Sternal setae: II, 6–10 (19: 7.9 ± 0.88); III, 5–10 (19: 7.8 ± 1.34); IV, 7–15 (18: 10.7 ± 2.14); V, 7–13 (18: 9.8 ± 1.72); VI, 6–10 (20: 7.8 ± 1.32); VII, 5–7 (20: 6.0 ± 0.60); VIII, 5–8 (20: 6.1 ± 0.64). Total length 1.300–1.450 (20: 1.388 ± 0.0413). Genitalia as in Fig. 9; sac having 4 large spines; parameral arch width 0.135–0.150 (20: 0.145 ± 0.0052); endomerale plate with wide apical bifurcation, width 0.075–0.090 (20: 0.085 ± 0.0047), length 0.075–0.095 (19: 0.084 ± 0.0065).

Female.—Much as in Fig. 6. Temple width 0.540–0.605 (20: 0.576 ± 0.0175); head length 0.355–0.405 (20: 0.383 ± 0.0119); submarginal and inner marginal temple setae 0.030–0.045 (18: 0.034 ± 0.0047) and 0.015–0.020 (20: 0.018 ± 0.0026) long, respectively. Prothorax width 0.385–0.420 (20: 0.399 ± 0.0109). Tergal setae: I, 2; II, 12–17 (20: 14.7 ± 1.16); III, 20–27 (19: 23.5 ± 2.04); IV, 22–31 (20: 26.4 ± 2.23); V, 23–33 (20: 26.2 ± 2.55); VI, 22–30 (20: $24.9 \pm$

1.97); tergal and pleural setae on VII, 27–37 (20: 32.0 ± 2.92). Longest seta of medial 10 on tergite VI, 0.065–0.080 (20: 0.073 ± 0.0041); on tergite VII, 0.110–0.145 (20: 0.132 ± 0.0079), with 8–9 (20: 8.1 ± 0.31) of these longer than 0.100. Longest seta of medial pair on tergite VIII, 0.020–0.040 (17: 0.028 ± 0.0059). Each side of last tergite with outer seta 0.050–0.100 (18: 0.076 ± 0.0145), middle seta 0.095–0.120 (19: 0.109 ± 0.0076), inner seta 0.100–0.130 (17: 0.112 ± 0.0067) long. Sternal setae: II, 7–10 (17: 7.9 ± 0.90); III, 6–11 (18: 8.1 ± 1.47); IV, 9–13 (18: 10.8 ± 1.44); V, 8–14 (19: 10.2 ± 1.68); VI, 7–12 (19: 9.9 ± 1.41); VII, 9–15 (19: 11.4 ± 1.64). Subgenital plate with 26–36 (20: 31.2 ± 2.24) setae. Total length 1.380–1.620 (19: 1.461 ± 0.0662). Genital sac as in Fig. 13, width 0.255–0.305 (19: 0.283 ± 0.0142), length 0.155–0.210 (20: 0.180 ± 0.0152), with lines extending near to anterior margin and with shallowly concave medioanterior margin.

Discussion. — Qualitatively, males of *G. costaricensis* are readily separated from the foregoing three species by having genitalia with a widely bifurcate endomeral plate and the genital sac with only 4 large spines (Fig. 9 vs. Figs. 5, 7, 8). Quantitatively, for males of *G. costaricensis* compared to those of *G. davidhaffneri*, the best characters and their critical values for discrimination and probabilities of misidentification were the genitalic parameral arch width 0.167 (0.001) and the number of setae on sternite VII 5.06 (0.019); compared to *G. setzeri*, the best were the head length 0.357 (0.006) and total length 1.291 (0.026); compared to *G. panamensis*, the best were the genitalic parameral arch width 0.180 (0.000) and endomeral plate length 0.110 (0.000).

The only qualitative feature for separating females of *G. costaricensis* from those of *G. setzeri*, *G. davidhaffneri*, and *G. panamensis* involves the shape and line configuration of the genital sac (Fig. 13 vs. Figs. 4, 12). Quantitatively, for females of *G. costaricensis* compared to those of *G. setzeri* and *G. davidhaffneri*, the best characters and their critical values for discrimination and probabilities of misidentification were the head length 0.355 (0.011), temple width 0.547 (0.030), and length of inner seta on each side of last tergite 0.100 (0.041); compared to *G. panamensis*, the best were the genital sac length 0.241 (0.001), genital sac width 0.363 (0.002), and number of setae on sternite III 9.81 (0.075).

Material examined. — 108 ♂, 54 ♀, *O. (M.) heterodus cartagoensis*, Costa Rica, Prov. Cartago, 2 km W Santa Rosa (4); Prov. Limon, Cervantes (3); Prov. San Jose, Volcan Irazu, Rancho Redondo (2). 57 ♂, 46 ♀, *O. (M.) heterodus dolichocephalus* (Merriam), Costa Rica, Prov. Alajuela, La Palmita (2). 38 ♂, 36 ♀, *O. (M.) heterodus heterodus*, Costa Rica, Prov. San Jose, 1 km SW Poas (4). Questionable host record: 1 ♂, *O. (M.) [underwoodi?]*, Costa Rica, Prov. San Jose, 14 km S La Gloria (1).

Geomydoecus cherriei Price

Figs. 10, 14

Geomydoecus cherriei Price, 1974: 43. Type-host: *Macrogeomys cherriei* = *Orthogeomys (Macrogeomys) cherriei* (J. A. Allen).

Male. — Much as for *G. costaricensis*, except as follows. Temple width 0.465–0.550 (17: 0.504 ± 0.0220); head length 0.305–0.380 (17: 0.343 ± 0.0191). Antenna with scape medial width 0.110–0.130 (15: 0.120 ± 0.0063), scape distal width 0.120–0.140 (15: 0.127 ± 0.0066). Prothorax width 0.335–0.395 (17: $0.357 \pm$

0.0185). Tergal setae on VI, 15–19 (16: 17.2 ± 1.48). Sternal setae: II, 8–10 (17: 8.6 ± 0.70); III, 6–11 (17: 9.0 ± 1.17). Total length 1.225–1.435 (17: 1.305 ± 0.0522). Genitalia as in Fig. 10; sac having only 3 large spines; parameral arch width 0.150–0.190 (16: 0.166 ± 0.0104); endomeral plate width 0.080–0.105 (16: 0.092 ± 0.0070).

Female.—Much as for *G. costaricensis*, except as follows. Temple width 0.515–0.590 (15: 0.546 ± 0.0239); head length 0.320–0.375 (15: 0.341 ± 0.0178); submarginal and inner marginal temple setae 0.025–0.035 (9: 0.030 ± 0.0025) and 0.010–0.015 (15: 0.014 ± 0.0021) long, respectively. Prothorax width 0.350–0.425 (15: 0.387 ± 0.0219). Longest seta of medial 10 on tergite VI, 0.060–0.075 (16: 0.069 ± 0.0048); on tergite VII, 0.105–0.135 (16: 0.120 ± 0.0102), with 4–8 (14: 7.1 ± 1.44) of these longer than 0.100. Longest seta of medial pair on tergite VIII, 0.015–0.030 (15: 0.023 ± 0.0046). Each side of last tergite with outer seta 0.045–0.080 (15: 0.063 ± 0.0117), middle seta 0.070–0.110 (13: 0.087 ± 0.0113), inner seta 0.080–0.100 (13: 0.093 ± 0.0075) long. Sternal setae: II, 7–11 (15: 8.7 ± 1.03); V, 8–13 (14: 8.9 ± 1.38); VI, 7–10 (15: 8.8 ± 1.01). Total length 1.195–1.415 (15: 1.329 ± 0.0612). Genital sac as in Fig. 14, width 0.280–0.340 (14: 0.300 ± 0.0220), length 0.175–0.235 (14: 0.211 ± 0.0175), with numerous lines most extending to anterior margin.

Discussion.—Qualitatively, males of *G. cherriei* are distinguished from all others in the *panamensis* complex by having genitalia with a widely bifurcate endomeral plate and the genital sac with only 3 large spines (Fig. 10 vs. Figs. 5, 7–9). Quantitatively, for males of *G. cherriei* compared to those of *G. costaricensis*, the best characters and their critical values for discrimination and probabilities of misidentification were the head length 0.366 (0.074) and genitalic parameral arch width 0.155 (0.098); compared to *G. davidhafneri*, the best were the length of the genitalic endomeral plate 0.096 (0.031) and number of setae on sternite VII 4.84 (0.095); compared to *G. setzeri*, the best were the width of the endomeral plate 0.082 (0.026) and width of the parameral arch 0.151 (0.028); compared to *G. panamensis*, the best were the endomeral plate length 0.108 (0.000), parameral arch width 0.191 (0.005), total length 1.470 (0.006), and head length 0.382 (0.007).

The only qualitative feature for distinguishing females of *G. cherriei* from those of the other taxa in the *panamensis* complex involves the shape and line configuration of the genital sac (Fig. 14 vs. Figs. 4, 12, 13). Quantitatively, for females of *G. cherriei* compared to those of *G. costaricensis*, the best characters were the head length 0.362 (0.073) and length of inner seta on last tergite 0.103 (0.087); compared to *G. setzeri* and *G. davidhafneri*, the best were the number of setae on tergite IV 23.71 (0.076) and number of setae on tergite V 23.91 (0.091); compared to *G. panamensis*, the best were the genital sac width 0.372 (0.009) and head length 0.379 (0.010).

Material examined.—20 ♂, 25 ♀, *O. (M.) cherriei*, Costa Rica, Prov. Alajuela, 7 km NE Quesada (1); Prov. Cartago, Santa Teresa Peralta (1); Prov. Limon, Pacuarito (3), Cariari (1). 7 ♂, 7 ♀, *O. (M.) matagalpae* (J. A. Allen), Nicaragua, Matagalpa (3), Rio Tuma (1).

The keys in Price and Emerson (1971) cannot be modified conveniently to include the taxa of the *panamensis* complex as they are presently defined. Therefore, the following keys may be used to identify *Geomydoecus* collected from gophers in the subgenus *Macrogeomys*.

KEYS TO TAXA OF THE *PANAMENSIS* COMPLEX

MALES

1. Endomeral plate of genitalia with wide apical bifurcation; genital sac with only 3–4 large spines (Figs. 9, 10) 2
- Endomeral plate with single apical point; genital sac with 6 large spines (Figs. 5, 7, 8) 3
2. Genital sac with 4 large spines (Fig. 9) *costaricensis* Price and Emerson
- Genital sac with only 3 large spines (Fig. 10) *cherriei* Price
3. Head length over 0.375; temple width over 0.525; total length over 1.490 4
- Head length under 0.375; temple width under 0.520; total length under 1.490 5
4. Sternite VII with 6 or fewer setae; temple width 0.605 or more; on *O. (M.) dariensis* *panamensis dariensis* Price and Emerson
- Sternite VII with 6 or more setae; temple width 0.605 or less; on *O. (M.) cavator* *panamensis panamensis* Price and Emerson
5. Endomeral plate shaped as in Fig. 8, with width over 0.085; parameral arch width over 0.160 *davidhaffneri*, new species
- Endomeral plate shaped as in Fig. 7, with width under 0.085; parameral arch width under 0.160 *setzeri* Price

FEMALES

1. Genital sac large (Fig. 3), over 0.360 wide, and mostly lacking lines in anterior area and lateroanterior "horns"; head length over 0.380 2
- Genital sac smaller (Figs. 12–14), under 0.360 wide, and with obvious lines in anterior area and/or lateroanterior "horns"; head length variably from 0.300–0.405 3
2. Temple width usually 0.640 or more; on *O. (M.) dariensis* *panamensis dariensis* Price and Emerson
- Temple width usually not over 0.640; on *O. (M.) cavator* *panamensis panamensis* Price and Emerson
3. Genital sac (Fig. 12) with deep medioanterior concavity and lacking lines in medioanterior area; head length not over 0.345; tergite IV with only up to 23 setae, V with only up to 25 *setzeri* Price
- Genital sac (Figs. 13, 14) with shallow medioanterior concavity and with lines extending to or near to anterior margin; either head length at least 0.350 or tergite IV with at least 22 setae and V with at least 23 *davidhaffneri*, new species
4. Head length not over 0.375 and length of inner seta on each side of last tergite not over 0.100; on *O. (M.) cherriei* and *O. (M.) matagalpae* *cherriei* Price
- Head length at least 0.355 and length of inner seta on each side of last tergite at least 0.100; on *O. (M.) heterodus* *costaricensis* Price and Emerson

LITERATURE CITED

- Hall, E. R. 1981. The Mammals of North America, 2nd Ed. Vol. I. John Wiley & Sons, New York.
xv + 600 + 90 pp.

- Hellenthal, R. A. and R. D. Price. 1980. A review of the *Geomydoecus subcalifornicus* complex (Mallophaga: Trichodectidae) from *Thomomys* pocket gophers (Rodentia: Geomyidae), with a discussion of quantitative techniques and automated taxonomic procedures. Ann. Entomol. Soc. Am. 73: 495-503.
- Price, R. D. 1974. Two new species of *Geomydoecus* from Costa Rican pocket gophers (Mallophaga: Trichodectidae). Proc. Entomol. Soc. Wash. 76: 41-44.
- Price, R. D. and K. C. Emerson. 1971. A revision of the genus *Geomydoecus* (Mallophaga: Trichodectidae) of the New World pocket gophers (Rodentia: Geomyidae). J. Med. Entomol. 8: 228-257.
- Price, R. D. and R. A. Hellenthal. 1980. The *Geomydoecus oregonus* complex (Mallophaga: Trichodectidae) of the western United States pocket gophers (Rodentia: Geomyidae). Proc. Entomol. Soc. Wash. 82: 25-38.